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# FLOOD INSURANCE STUDY

## TOWN OF WILSON CREEK, WASHINGTON
### GRANT COUNTY

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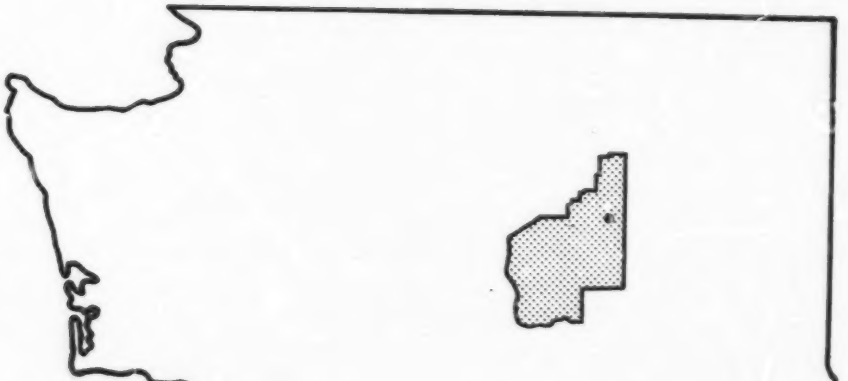

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JULY 15, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 530056

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
TOWN OF WILSON CREEK, GRANT COUNTY, WASHINGTON

## 1.0 INTRODUCTION

### 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Wilson Creek, Grant County, Washington, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence; and the State (or other jurisdictional agency) will be able to explain them.

### 1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U. S. Army Corps of Engineers (COE), the Seattle District, for the Federal Emergency Management Agency (FEMA), under InterAgency Agreement No. IAA-EMW-E-1153, Project Order No. 1. This study was completed in November 1984.

### 1.3 Coordination

The streams to be studied were identified during a July 1982 meeting of representatives of FEMA, the Town of Wilson Creek, and the study contractor.

Requests for relevant information concerning flood hazards in the Town of Wilson Creek were sent to Mr. Ben Goodwin, Chairman of the Grant County Board of Commissioners, and to the Honorable Robert Rabidue, Mayor of Wilson Creek. A similar request was published in the Odessa, Washington Record on September 29, 1983. No new information was brought to light.

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On August 7, 1987, the results of the study were reviewed at the final meeting attended by representatives of the study contractor, FEMA, and the community. The study was acceptable to the community.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Town of Wilson Creek, Grant County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

Wilson Creek and Crab Creek were studied by detailed methods within the corporate limits of the Town of Wilson Creek for a distance of approximately two miles.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1989.

### 2.2 Community Description

The Town of Wilson Creek is located in eastern Grant County in eastern Washington and is situated approximately 100 miles west of Spokane, Washington. According to U.S. Census Bureau data, the population increased from 184 in 1970 to 222 in 1980 (Reference 1).

Most of the town has been developed. Within the floodplain studied, development consists of farm facilities and pasture, single-family residences, small businesses, and warehouse/railroad facilities.

The Town of Wilson Creek is situated within the Crab Creek basin. Crab Creek flows generally from the eastern corporate limits to the western corporate limits and is joined by Wilson Creek near the southeast corner of town. A small unnamed tributary which joins Crab Creek at the far western edge of town will be referred to in this study as Unnamed Tributary 1.

The Crab Creek basin, in the rain shadow of the Cascade Mountains, has an arid to semiarid climate with little precipitation, hot summers, and cold winters. Mean annual precipitation ranges from 8 to 17 inches with most of the precipitation occurring during the winter. Summer rainfall is sometimes associated with thunderstorms which occur on about 10 to 15 days each summer, usually as isolated cells covering only a few square miles. Mean seasonal snowfall ranges from 15 to 50 inches. Temperatures can range from as high as 113 degrees Fahrenheit to as low as -30 degrees Fahrenheit.



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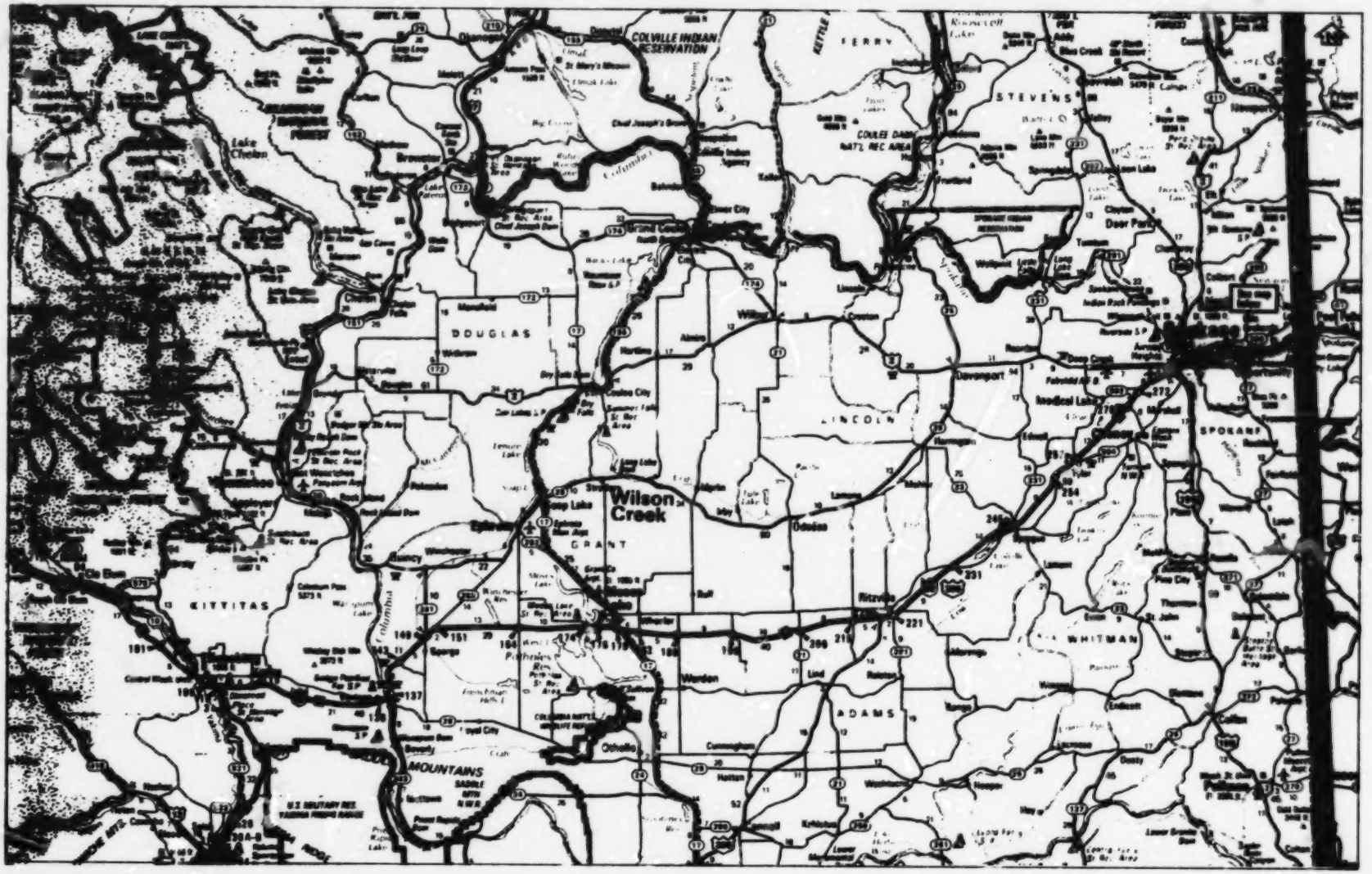


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

**TOWN OF WILSON CREEK, WA**
**(GRANT CO.)**

APPROXIMATE SCALE

20 0 20 40 60 MILES

**VICINITY MAP**

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The mean annual precipitation for Wilson Creek is 9.2 inches. The mean annual snowfall is 19.3 inches. Average summer temperatures range from 84.3 degrees Fahrenheit to 48.7 degrees Fahrenheit. Average winter temperatures range from 37.7 degrees Fahrenheit to 21.5 degrees Fahrenheit (Reference 2).

## 2.3 Principal Flood Problems

Most flooding problems in the Crab Creek basin occur from extreme runoff events of short duration. These flash floods are usually caused by heavy rain on snow-covered frozen ground. This type of event will be referred to as winter rainflood in this study. Severe spring and summer thunderstorms can also cause extensive flooding.

Numerous floods have occurred at Wilson Creek since 1900. The flooding source can be either Crab or Wilson Creek, but is usually a combination of both. The four largest floods occurred in February 1932, February 1957, January 1959, and February 1963. The peak flows for the 1932 and 1957 floods, estimated from slope-area measurements, were 5,000 cubic feet per second (cfs) and 12,500 cfs, respectively. The estimated recurrence intervals for floods of these magnitudes are 8 and 45 years. Although no estimates were made of the peak flows for the 1959 and 1963 floods, nearby stream records and descriptions provided by local residents indicate both floods were larger than the 1932 flood.

Extensive flooding occurred in the February 1957 flood, reported to be the largest deluge ever to hit the Town of Wilson Creek. Virtually the entire town was inundated by about 4 to 5 feet of water as Wilson Creek overtopped and breached the dike, allowing 80 percent of its flow to pass through the business district. This dike will be overtopped by the 100-year flood. Residences and businesses were damaged extensively, streets were eroded, bridges were washed out, and large sections of the dike were destroyed. The flooding was aggravated by the failure of Bennett's Dam, located about 2 miles west of town, which increased the peak flow on Wilson Creek by about 5,000 cfs. Ice and debris jams at narrow bridge openings also aggravated the flooding.

## 2.4 Flood Protection Measures

No major steps have been taken to mitigate flooding problems in Wilson Creek. Some floodproofing, building restrictions, and channel improvements have been implemented. The channel improvements primarily involved construction of levees, which were ineffective during the 1957 flood, but did reduce flooding during the 1959 and 1963 floods.

Only levees providing protection from 100-year flood events are shown as having any effect on Flood Insurance Rate Maps.



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## 3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

### 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed affecting the community.

Because serious flooding in Wilson Creek can occur from either winter rainfloods or summer thunderstorms, a separate discharge-frequency curve analysis was accomplished for each. The resulting curves were then combined by standard statistical methods to define the frequency of discharge considering the two types of flooding.

A regional winter rainflood relationship was developed following established guidelines (References 3, 4, and 5) by analyzing the peak flows from twenty-five U.S. Geological Survey stream-gaging stations for hydrologically similar watersheds in the Columbia River basin. The peak runoff data from two of these gages (Wilson Creek at Wilson Creek, Station No. 12465500, and Crab Creek at Irby, Station No. 12465000) are more representative of the Wilson Creek basins than the regional relationship. Statistical analyses of the Wilson Creek at Wilson Creek and Crab Creek at Irby stream-gage data, following the standard log-Pearson Type III method (Reference 4), were used to develop the winter rainflood discharge-frequency curves for Wilson and Crab Creeks at Wilson Creek, respectively.

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A regional thunderstorm relationship was developed by analyzing thunderstorm floods in the Columbia River basin. This relationship was compared with the regional winter rainflood relationship and with detailed thunderstorm studies made by the COE for Canyons 1 and 2 at Wenatchee, Washington (Reference 6), and Placer Creek, Idaho (Reference 7). Both comparisons verified the reasonableness of the regional thunderstorm analysis. Because no thunderstorm data exist for Wilson Creek, the regional thunderstorm analysis was used to develop the thunderstorm discharge-frequency curves for all potential flooding sources in Wilson Creek.

Peak discharge-drainage area relationships for Wilson and Crab Creeks are shown in Table 1.

TABLE 1. SUMMARY OF DISCHARGES

| Flooding Source and Location | Drainage Area (square miles) | Peak Discharges (cubic feet per second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Crab Creek | | | | | |
| Below confluence with Wilson Creek | 1,765.0 | 5,850 | 13,100 | 17,500 | 28,600 |
| Upstream Corporate Limits | 1,338.0 | 5,300 | 12,000 | 15,700 | 26,100 |
| Wilson Creek | | | | | |
| At Mouth | 427.0 | 3,900 | 8,900 | 12,000 | 21,500 |
| Unnamed Triburary 1 | | | | | |
| At Mouth | 2.6 | 170 | 490 | 720 | 1,650 |

## 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Two hydraulic analysis cases were studied to determine which caused greater flooding: (1) primary flood on Wilson Creek with coincidental flows on Crab Creek and (2) primary flood on Crab Creek with coincidental flows on Wilson Creek. The analysis revealed that the first combination caused greater flooding. The limits of this flooding are shown on the Flood Insurance Rate Map (Exhibit 2).

Cross sections for backwater analysis of the streams in the study area were obtained from aerial photographs at a scale of 1:12,000 flown on March 16, 1983. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.



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Roughness factors (Manning's "n") used in the hydraulic computations were chosen using engineering judgment and based on field observations of the streams and floodplain areas. Roughness values for the main channels of Wilson and Crab Creeks ranged from 0.039 to 0.062, while floodplain roughness values ranged from 0.044 to 0.090 for all floods.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE G3722110 Water-Surface Profiles computer program (Reference 8). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for this study were calculated using the slope-area method. All elevations are referenced to the National Geodetic Vertical Datum (NGVD) of 1929. Elevation reference marks used in this study are shown on the maps and described in Elevation Reference Marks (Exhibit 3).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

## 4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

### 4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the



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boundaries were interpolated using topographic maps at a scale of 1" = 400', with a contour interval of 4 feet (Reference 9).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

## 4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated at selected cross sections (Table 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.



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| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NGVD) | | | |
| Crab Creek | | | | | | | | |
| A | -200 | 601/0[2] | 5,282 | 3.3 | 1278.5 | 1278.5 | 1279.0 | 0.5 |
| B | 740 | 972/690[2] | 6,813 | 2.6 | 1279.3 | 1279.3 | 1279.8 | 0.5 |
| C | 1615 | 1074/630[2] | 6,673 | 2.6 | 1279.7 | 1279.7 | 1280.2 | 0.5 |
| D | 2245 | 1011/630[2] | 7,854 | 2.2 | 1280.1 | 1280.1 | 1280.5 | 0.4 |
| Wilson Creek | | | | | | | | |
| E | 3105 | 1185/670[2] | 10,999 | 1.6 | 1280.5 | 1280.5 | 1280.9 | 0.4 |
| F | 3705 | 2012/1150[2] | 16,332 | 1.1 | 1280.6 | 1280.6 | 1281.0 | 0.4 |
| G | 4435 | 1900 | 8,021 | 1.5 | 1281.1 | 1281.1 | 1281.6 | 0.5 |
| H | 5355 | 968 | 3,885 | 3.1 | 1281.8 | 1281.8 | 1282.8 | 1.0 |
| I | 5845 | 417 | 2,831 | 4.2 | 1282.7 | 1282.7 | 1283.5 | 0.8 |
| J | 6415 | 399 | 3,365 | 3.6 | 1283.9 | 1283.9 | 1284.7 | 0.8 |
| K | 7365 | 307 | 1,965 | 6.1 | 1287.4 | 1287.4 | 1288.2 | 0.8 |
| L | 8445 | 335 | 1,879 | 6.4 | 1292.4 | 1292.4 | 1293.3 | 0.9 |
| M | 9685 | 501/430[2] | 2,474 | 4.9 | 1299.2 | 1299.2 | 1299.9 | 0.7 |

[1]Stream distance in feet above western corporate limit
[2]Width/width within corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

**TOWN OF WILSON CREEK, WA**
**(GRANT CO.)**

**FLOODWAY DATA**

**CRAB CREEK - WILSON CREEK**

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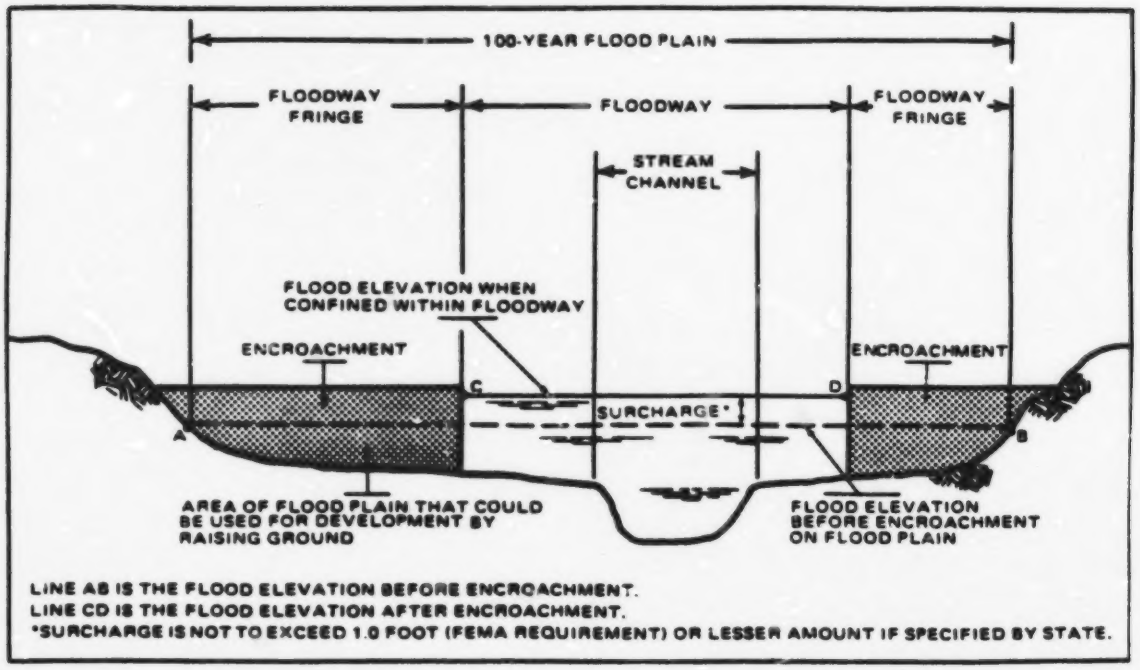
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

## 5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.



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Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

## 6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

## 7.0 OTHER STUDIES

The of the COE, Seattle District, made preliminary studies for flood control for the Town of Wilson Creek in 1958 and 1972.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Maps for the Town of Wilson Creek, Grant County, Washington (Reference 10). This study also supersedes the two previous preliminary studies in 1958 and 1972.

## 8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Federal Regional Center, 130 228th Street, S.W., Bothell, Washington 98021-9796.



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## 9.0 BIBLIOGRAPHY AND REFERENCES


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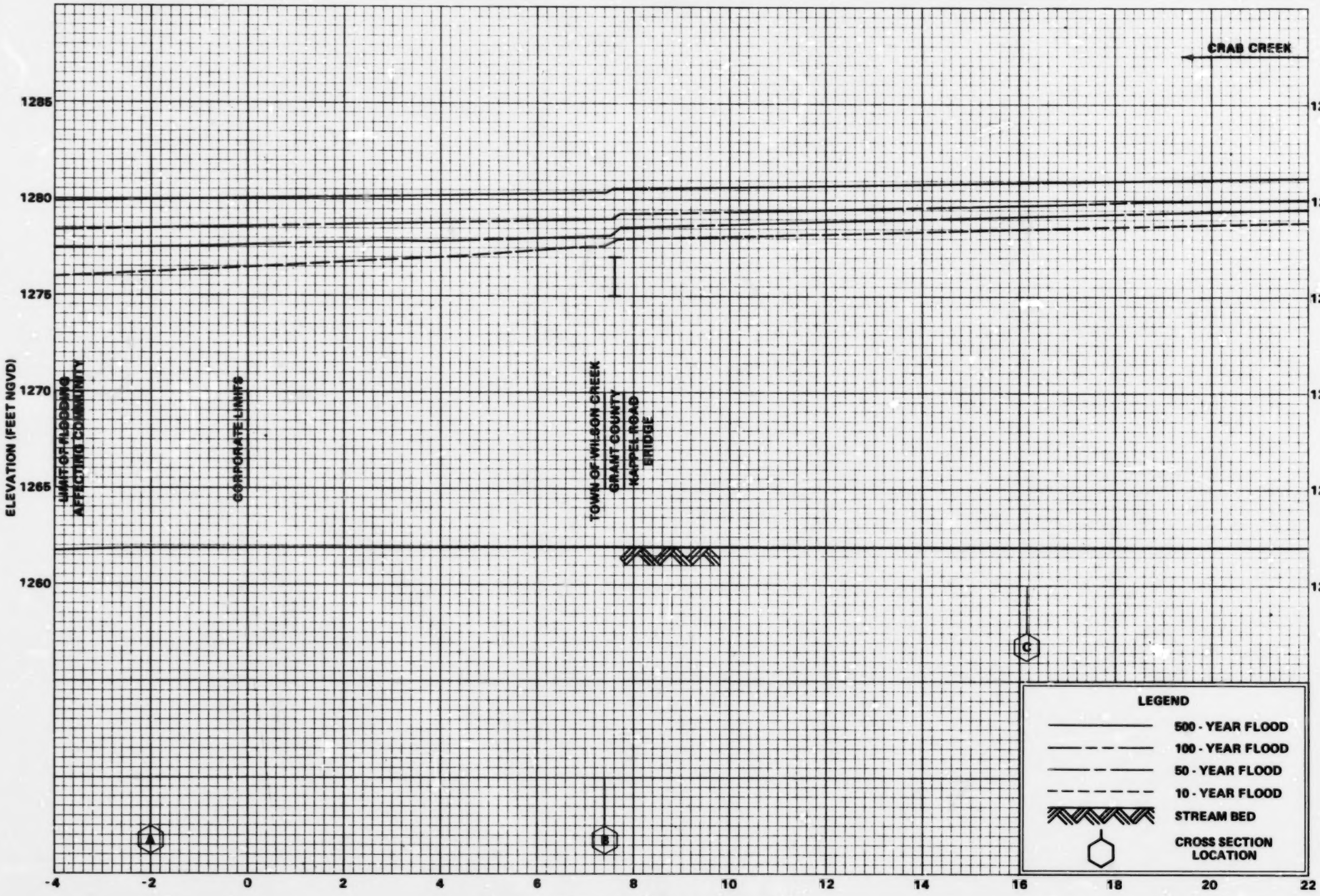


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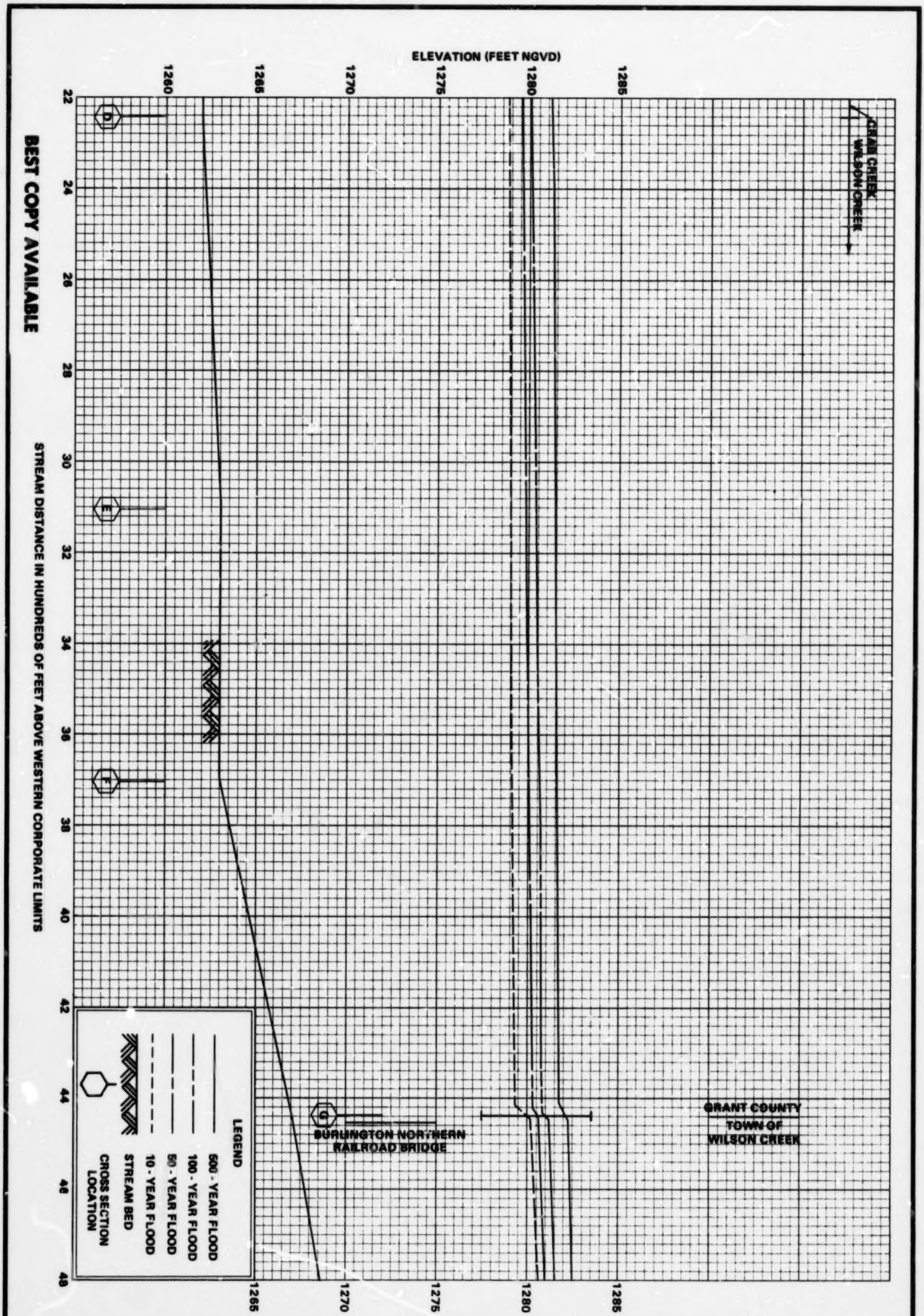
FLOOD PROFILES

CRAB CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WILSON CREEK, WA
(GRANT CO.)

01P

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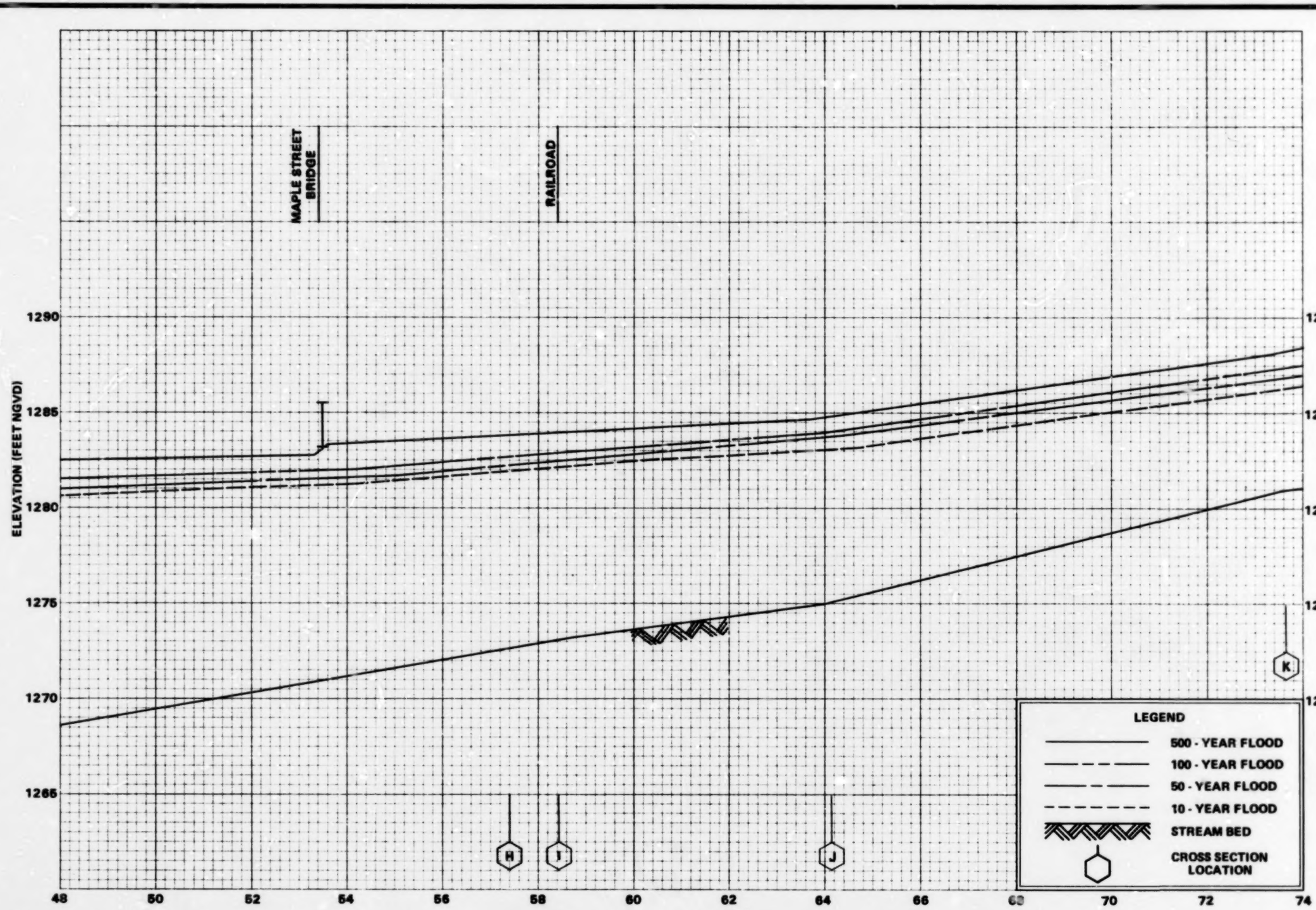
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WILSON CREEK, WA
(GRANT CO.)

FLOOD PROFILES

CRAB CREEK - WILSON CREEK




FLOOD PROFILES

WILSON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WILSON CREEK, WA
(GRANT CO.)

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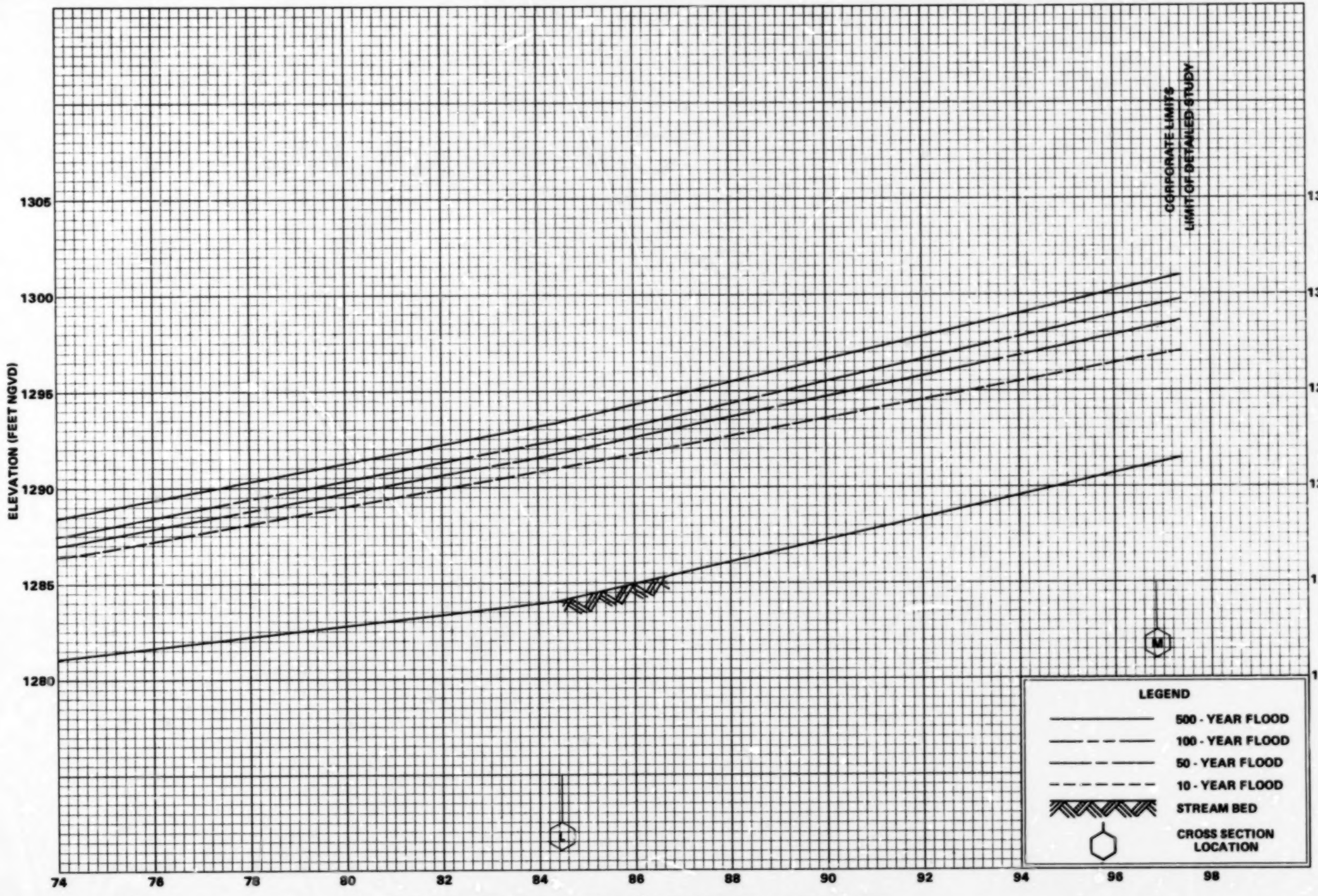


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**FLOOD PROFILES**

**WILSON CREEK**

FEDERAL EMERGENCY MANAGEMENT AGENCY

**TOWN OF WILSON CREEK, WA**
(GRANT CO.)

**04P**

EXHIBIT 3 - ELEVATION REFERENCE MARKS
TOWN OF WILSON CREEK, GRANT COUNTY, WASHINGTON

| Reference Mark | Elevation (feet NGVD) | Description of Location |
|---|---|---|
| RM 1 | 1276.74 | USGS Brass Cap #18 FMK located on step of Old Wilson Creek Bank building on the southwest corner of Railroad and 3rd Streets. |

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